CHAPTER 8

THE SUPPORT SUBSYSTEM

The subsystem most critical to the operation of a complete electronic system is its support subsystem. The complete electronic system is rendered inoperable without the efficient functioning of all units within this subsystem. The support subsystem includes the primary, emergency, and standby power sources, and the temperature and humidity control units which, as the subsystem's name implies, support the other subsystems.

This chapter will discuss the various power sources and environmental requirements of an activity. Though general in nature, the information provided in the following text is necessary in the performance of your maintenance duties. As a CTM you will not normally be assigned the maintenance responsibilities of this subsystem, but you may be called upon to assist the personnel that are responsible. This text is designed to acquaint you with the basic requirements and operation of the units contained in the support subsystem and should be a part of your knowledge of the overall electronic system.

ELECTRICAL POWER REQUIREMENTS

Naval Security Group Elements must have a reliable source of electrical power to support the operation of sensitive electronic equipment.

Power sources and distribution systems are planned and designed by the Naval Facility to meet Naval Security Group requirements. Power system reliability is obtained through the installation of various combinations of primary, emergency, standby, and uninterrupted (UPS) power systems.

The following electrical load definitions, terms, and categories will enable you to better understand the material contained in this section. (See figure 8-1.)

Station Load: The total power requirement of the station.

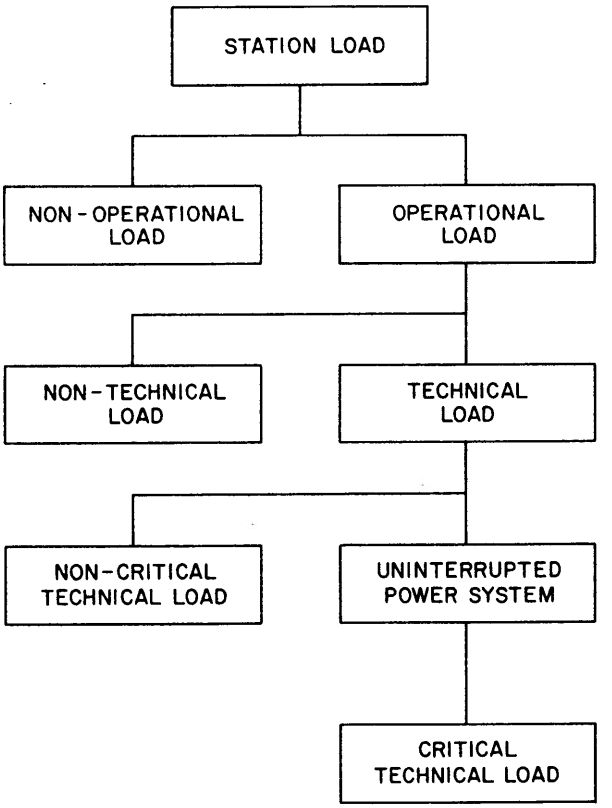

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Figure 8-1.—Power Load Categories.

Non-Operational Load: Total power required for personnel support facilities, support housing, and administrative facilities.

Operational Load: Total power required for communications/operational facilities.

Non-Technical Load: That portion of the operational load used for general lighting, air conditioning, ventilation, etc., for normal operation.

Technical Load: That portion of the operational load, including minimum lighting and air conditioning/ventilation, required to maintain continuity of operations.

Non-Critical Technical Load: Operational equipment not dependent upon synchronous operation and not requiring uninterrupted power.

Critical Technical Load: That portion of the operational equipment dependent upon synchronous operation and requiring uninterruptible power.

Primary Power: Normal source of power, either commercial or government owned, which serves the station main lines.

Stand-By Power: An auxiliary generator plant capable of providing electrical service during extended (days) outage of the primary power source.

Emergency Power: A quick start auxiliary generator plant used to restore power during primary system failures. Generators should be equipped with automatic starting features and be capable of accepting a load within one minute of start. These generators should be capable of operating for short term (hours) outage periods.

Uninterruptible Power System (UPS): A system using stored energy to provide continuous power and to limit voltage and/or frequency deviations for the critical technical load.

Uninterruptible Power System (UPS) Backup: A generator specifically identified to provide emergency power to an installed Static UPS. The backup capability is provided when existing emergency power is inadequate to handle the additional load.

ELECTRICAL POWER LOAD CATEGORIES

The Naval Security Group electrical power load is divided into the categories shown in figure 8-1 according to allowable down-time. The non-technical load can tolerate down-time of several hours or more without materially reducing the mission performance. This category includes general lighting, general air conditioning (not essential for equipment cooling), convenience outlets for tools and cleaning equipment, and habitability items. The non-critical technical load can accept an electrical power outage of up to two minutes. This category includes equipments where continued operation is essential to the assigned mission such as non-synchronous communications equipment, necessary test equipment, emergency lighting, and ventilation and air conditioning necessary for continuous cooling of electric equipment. Critical technical loads are those that cannot tolerate any down-time; for these loads an Uninterruptable Power System (UPS) must be used. This category includes any unit of equipment, whether an individual unit or part of a system, that will malfunction during a momentary power drop-out and cause:

- Additional outage after normal or emergency power restoration caused by a need to resynchronize.

- Loss of real-time count by master time sources with attendant loss caused by resynchronization with the distant time source.

- Loss of buffered data in automated control and processing systems.

NAVSECGRUINST 11310.1 provides detailed guidance on UPS loading requirements. Figure 8-2 is a diagram of a typical UPS.

Primary Power Sources

Primary power for a shore based electronics facility is normally obtained by lease from the local commercial power company. The quantity of power obtained from the local power

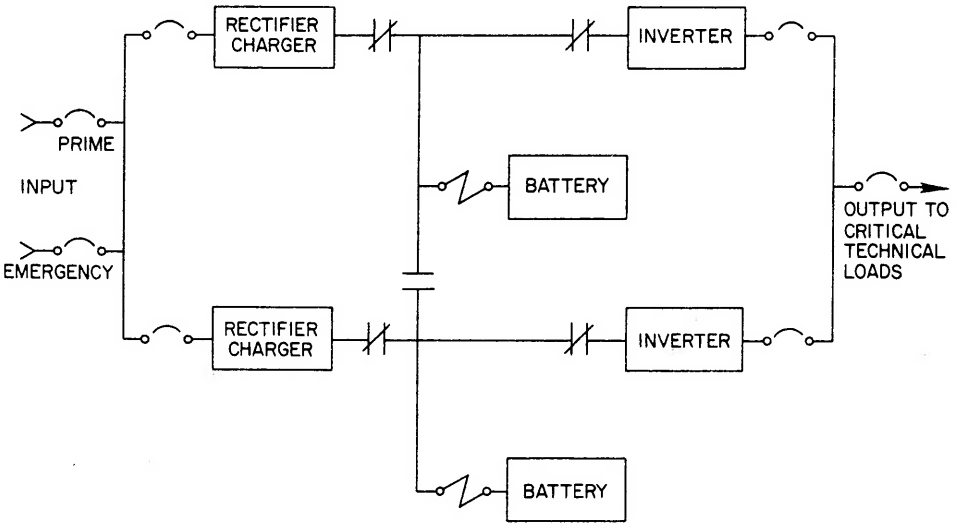

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Figure 8-2.—Typical UPS (Static) 100kw.

company is dependent upon the full load requirements of the station's electronic system plus the requirements of the station's normal utilities.

An isolated station, however, must obtain its primary power from the most practicable source. This source may be from a commercial power company or from a local generator system installed on station. If the primary power for use on station is obtained from an on-station generator system, the requirements for power are determined upon initial installation. The initial provision for power includes an allowance for expansion which is based on equipment required for 125 percent of the full electronic equipment load and station utility requirements.

Primary power for an activity afloat is derived from the ship's generators while underway, and from the port authority's primary power source when in port. The ship's generators supply sufficient power to operate all electronic and electrical components onboard at peak power. The primary power aboard ship is of two frequencies. These are the normal 60 Hertz and the 400 Hertz supplies. The 400 Hz primary power is normally used for operation of the equipments requiring high voltages. Some of the equipments which you will encounter aboard ship that may use 400 Hz primary power are communications transmitters, receivers; and aboard large vessels, sonic cleaning units.

All primary power sources, wherever they are required, must be of sufficient capacity to provide the peak electric power required during normal peacetime operations.

Emergency Power Sources

The need for an emergency power source is immediately recognized when you realize that a failure of the primary power source cuts the vital communication links to the activity, effectively isolating that activity from command. Thus, the emergency source must be of sufficient capacity to provide the electric power demand for vital operations for which no interruption of operation can be accepted. This source is usually one or more engine-driven, manual, or automatic starting emergency generators. An adequate fuel supply is provided to permit extended operation without refueling from outside sources.

Standby Power Sources

An alternate or standby source is used as a back-up for the primary source in that it must

be of such capacity that it alone can supply the minimum essential operating electric load of the activity. Also, when added to the capacity of the primary source, will provide a combined capacity sufficient to furnish the estimated peak demand under mobilization conditions. The same requirements for fuel oil exist as for the emergency power source.

Uninterruptable or No-Break Power Sources

An uninterruptable or no-break power source is highly desirable, if not vital, at large shore activities. This is especially true at a communications station used as a primary relay point for naval communications. The no-break power unit is used in conjunction with the primary power source. When used in this manner, the frequency of the primary power to the communications station can never vary more than one Hertz and the voltage can never drop to less than 80 percent of normal.

An interruption of the primary power source on any or all phases causes the no-break unit to take over as the primary power source. An interruption can be one or more of several abnormalities of the primary power source. These abnormalities are: a short circuit or an open circuit on any one or more phases of the primary power source; an over-voltage of 10 percent; or an under-voltage of 20 percent; or a ± 0.5 Hz shift in frequency.

The no-break power unit is rated at 120/208 volts, 60 Hertz, three phase, with frequency regulation of ±0.5 Hz and voltage regulation of ±2 percent. This unit will not allow the voltage to drop to less than 80 percent of normal, and will return to the regulated value within 5 seconds or less. The frequency will not be allowed to drop to less than 58 Hz during transition and will return to 60 Hz within 15 seconds or less.

ENVIRONMENTAL EFFECTS

It is beyond the scope of this section to present all the problems encountered from environmental conditions, because individual methods of installation and stowage of electronic equipments differ from ship to ship, and from one Naval shore station to another. However, some of the preventive and corrective measures that should be taken under adverse environmental conditions, and the effects on the equipment subjected to these conditions, are given in the following paragraphs.

TEMPERATURE

The cooling or heating of air spaces surrounding the components of electronic equipment is generally accomplished and controlled by blowers, fans, hot oil and water coolers, etc., either to dissipate the heat generated by the equipment components, or to heat or cool the surrounding ambient air. Regardless of the method employed for the cooling or heating of spaces, if maintenance personnel neglect to keep the screens, filters, fans, ducts, surface area of coolers, and equipment free from foreign matter, the heating or cooling will be greatly affected, which may result in equipment damage or malfunction caused by improper temperature control.

Extremely low temperature may cause brittleness in certain types of metals, and loss of flexibility in rubber, insulation, and similar materials.

Extremely high temperature may cause deformation and deterioration of terminal boards, seals, insulation, and heat sensitive devices.

Rapid changes of temperature may be especially damaging to certain types of electronic components.

HUMIDITY

High humidity, the "arch enemy" of electronic equipment, with its resultant damage to equipment components from condensation and fungus growth, under conditions of both high salt-laden moist air and high temperature, is normally found in tropical climates. In this case, adequate ventilation of the equipment is of the utmost importance to protect the equipment components from entrapped moisture and extremely high operating temperatures. To overcome any adverse effects on electronic

equipments, maximum and minimum temperature gradients should be controlled by one of the cooling or heating mediums provided.

In many cases, critical electronic components are encapsulated, potted, or sealed to protect them from the detrimental effects of moisture and temperature variations. However, sealing the component does not completely eliminate the problem of high-humidity conditions because the seals sometimes must be broken for maintenance or repair work. There is also the possibility that the maintenance technician will not always have the suitable sealing compounds on hand to repair or replace sealed components. Where this condition exists, except in cases of emergency, the repair or replacement of sealed components should not be performed in the field.

Temperature and Humidity Control

The actual climatic conditions of the applicable weather zone in which an activity is located will dictate the requirements for temperature and humidity control. In general, the air conditioning system must be capable of maintaining a constant temperature below 80 degrees Fahrenheit and a relative humidity of not more than 60 percent at the air intakes to electronic equipment, with all equipment in operation. The more frigid zones may require a heating system to maintain a minimum temperature of 70 degrees Fahrenheit.

The environmental control units provide for a recirculation of inside air with a provision for discharging 20 percent to the outside and intaking 20 percent from the outside. The outdoor air intake is well filtered to remove dust.

CORROSIVE ATMOSPHERE.—The effect of a corrosive atmosphere on metal parts, insulation, etc., can cause serious damage to unprotected electronic equipment. For this reason, the maintenance technician should be cognizant of the harmful effects of all corrosive elements. He must be especially aware of the effects produced by salt spray or salt-unpregnated air. To prevent corrosive effects, a regular periodic cleaning schedule should be established. This schedule should include dusting and cleaning, lubrication of moving parts, and the application of approved solvents or wetting agents to remove any accumulation of foreign matter, such as soil, dust, dirt, oil film, salt-impregnation, etc. In addition, all access doors and panels should be fastened securely and in place when no maintenance work is being performed on the equipment.

BAROMETRIC PRESSURE EFFECTS.—Electronic equipment installed in aircraft or submarines is often subjected to severe changes in barometric pressure. To overcome any adverse effects on the equipment, pressurization of individual components by use of pressurized chambers is often employed. These components are hermetically sealed to prevent variations in barometric pressure, and are generally classified as throwaway or nonrepairable items. Therefore, the maintenance technician should not attempt to repair such items.

STANDBY EQUIPMENT.—Equipment that is to remain idle and deenergized for a considerable length of time should have their space heaters (if provided) turned ON to keep the insulation and equipment dry. If space heaters are not provided for the equipment, electric lamp bulbs or a portable electric heater as a temporary measure can be placed within or near the equipment. This is especially important in humid or cold climates.